AbstractID: 12804 Title: Development and Dosimetric Studies of Independent Dose Validation Software on Helical Tomotherapy

Purpose: To develop a 2nd dose validation software for helical TomoTherapy, study the sensitivity of the commission data variation on the final dosimetry impact, and inter-fraction setup uncertainty effect for patient quality assurance.

Method and Materials: A 2nd dose validation software for helical TomoTherapy, called *MU-Tomo,* has been developed to independently validates point dose upon archived patient documents, initial coordinates and planned dose of point of calculation, and common dosimetric functions. *MU-Tomo* has been validated with a hundred cancer cases (30 prostate, 26 head&neck, 18 lung, 17 pelvis, and 9 brain patients). Sensitivity studies were performed by oscillating fluctuation regions of off-axis profiles, shifting, and rotating profiles. Daily setup shifts were quantified into systematic and random shifts to evaluate dosimetric variations, separately.

Results: For dose validation, 98% of dose differences are within ±5% with mean 0.20%±2.06%. Sensitivity studies show linear response by oscillating OARy, 15 times larger dose variation by shifting OAR_y than OAR_x, and less than 1.5% difference by rotating OAR_x in ±6° and more than 5% in ±1° by rotating OAR_y. Systematic variations are up to -10.02%±3.00%. Mean random variations are up to -5.65%±1.90%. ANOVA analyses show significant differences among patient random dosimetric variations and systematic dosimetric variations between head&neck-brain group and body group. Variations are not significantly correlated with treatment fraction number with the Pearson correlation analysis. The overall random dosimetric impacts to each patient are -0.0053%±1.11%.

Conclusion: *MU-Tomo,* has been developed for TomoTherapy dose validation. Sensitivity studies on fifty patients have been evaluated that OARy profiles are more sensitive than OAR_x in dose calculation. Dosimetric consequences due to inter-fractional setup shifts on a hundred helical tomotherapy patients were assessed.

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